

IN THE UNITED STATES DISTRICT COURT
FOR THE MIDDLE DISTRICT OF NORTH CAROLINA

GLASTON CORPORATION, and)	
UNIGLASS ENGINEERING OY)	
)	
Plaintiffs.)	
)	
v.)	1:21-cv-942
)	
SALEM FABRICATION TECHNOLOGIES)	
GROUP, d/b/a HHH EQUIPMENT)	
RESOURCES,)	
)	
Defendant.)	

MEMORANDUM OPINION AND ORDER

THOMAS D. SCHROEDER, District Judge.

Plaintiffs allege infringement of two patents, United States Patent No. 8,479,540 (the “’540 Patent”) and United States Patent No. 8,650,911 (the “’911 Patent”), that detail a method and apparatus for heating and tempering glass. The parties dispute the meaning of several of the terms in the patents’ claims; and Defendant contends certain claims are indefinite. The parties’ contentions have been briefed (Docs. 38, 39, 40, 45, and 46), and the court held a claim construction hearing on February 23, 2024. For the reasons set forth below, the court declines to find certain challenged terms indefinite and adopts all of Plaintiffs’ proposed constructions.

I. BACKGROUND

The '540 Patent (Docs. 14-1) and the '911 Patent (Doc. 14-2)¹ are related patents held by Plaintiff Uniglass Engineering OY ("Uniglass") and licensed exclusively to Plaintiff Glaston Corporation ("Glaston") for its use in tempering glass (Doc. 14 ¶¶ 12-14).² Both patents pertain to tempering glass by heating it "from above and below using different energy absorption principles" so that the top and bottom of the glass are heated at different rates, leading to better and more even tempering. (Doc. 14 ¶ 19; '540 Patent at 2:11-45.³) Specifically, the top surface of the glass is heated with recirculated pressurized hot air taken from inside the furnace, while the bottom surface of the glass is heated with pressurized air taken from outside the furnace as well as by means of electric resistors. ('540 Patent at 2:11-26.) These patents build upon prior art for glass tempering, including WO Publication 97/44283, WO publication 01/32570 ("Vehmas

¹ For ease of reference, the court cites to the column and line of the patent number rather than the docket entry.

² There is a pending motion to dismiss Plaintiff Glaston. (Doc. 57.) Because the outcome of that motion would not affect construction of the claim terms as to Plaintiff Uniglass, the court need not reach it now.

³ Apart from the claim terms themselves, the '540 Patent and the '911 patent are nearly identical, containing the same background, specification, and figures with only a few differences in line numbering and minor word changes. The parties have acknowledged as much. (See, e.g., Doc. 38 at 6 n.1.) Therefore, when discussing the contents of both patents, the court cites only to the '540 patent for simplicity's sake. When the discussion affects only one of the patents, the specific patent at issue will be cited.

Patent”), and US 2002/0134109 (“Vitkala Patent”), which had previously disclosed the heating of glass using air recirculated from inside the furnace and using air from outside the furnace but had never combined them for the differential heating of glass from the top and bottom. The ‘540 Patent concerns the method for heating the glass (Doc. 14 ¶ 40), while the ‘911 Patent focuses on the apparatus for doing so (id. ¶ 21).

Plaintiffs contend that Defendant Salem Fabrication Technologies Group, Inc., d/b/a HHH Equipment Resources (“Salem”) has infringed on both patents directly and by assisting a third-party’s infringement. (Doc. 14.) Namely, Plaintiffs allege that Luoyang North Glass Technology Co. (“Northglass”), a non-party for which Salem is an authorized agent, uses furnaces in its AU series products that infringe Plaintiffs’ patents, that Salem contributed to and induced this infringement, and that Salem independently infringes the patents through its use, offer to sell, sale, and importation of Northglass’s products. (Id. ¶¶ 1, 16-52.) Plaintiffs contend that this infringement is willful, sufficient to support an award of treble damages pursuant to 35 U.S.C. § 284. (Id. ¶¶ 37, 52.) Salem denies infringement of either of the patents and asserts counterclaims seeking declarations of non-infringement and invalidity for both patents. (Doc. 24 at 14-26.)

Pursuant to Local Patent Rule 104.3, the parties filed a joint claim construction statement, agreeing on the meaning of several

patent claims and disputing others. They agreed on the following constructions:

- A "means for blowing the pressurized air back to an upper surface of the glass," as recited in the '911 Patent, Claim 1, is a means plus function term covered by 35 U.S.C. § 112(f), where the corresponding structure is "upper side blowpipes and equivalents thereof" and the function is "blowing the pressurized air back to an upper surface of the glass."
- A "means for heating the air pressurized by the compressor," as recited in the '911 Patent, Claim 1, is a means plus function term covered by 35 U.S.C. § 112(f), where the corresponding structure is "an underside feed pipe arranged in the lower part of the furnace and/or a separate heater and equivalents thereof" and the function is "heating the air pressurized by the compressor."

(Doc. 32 at 12; Doc. 32-1.) They further identified several disputed claim terms for resolution by the court. (Doc. 32 at 13-25; Doc. 32-2.) After providing their proposed constructions and the intrinsic and extrinsic evidence supporting their positions as part of the joint document, as well as opening and responsive claim construction briefing (Docs. 38, 40, 45, 46), the parties stipulated to the withdrawal of certain claims for construction. (Doc. 68).⁴ Therefore, the following claim terms are subject to

⁴ The parties represented to the court that the term "wherein the pressurizing comprises turbocharging" no longer required construction, as Plaintiffs had agreed not to claim infringement under the '540 Patent, Claims 4, 7, 9, 11, 12, and 15, and Salem had agreed to withdraw its counterclaims for declaratory judgment based on both non-infringement and invalidity for those same claims. (Doc. 68 at 2.) In addition, the parties informed the court that they had reached agreement on the following construction: "hot air jets," as recited in the '540 Patent, Claim 1, means "air jets at elevated temperature."

the parties' dispute:

- "the improvements consisting essentially of," as recited in the '540 Patent, Claim 1
- "sucking [hot] air from inside the [tempering] furnace," as recited in the '540 Patent, Claim 1, and in the '911 Patent, Claim 1
- "controlled in a forced manner so as to heat at a power level in accordance with a heating profile," as recited in the '540 Patent, Claims 3, 12, 13, 14
- "heat, using forced control, at a power level in accordance with a heating profile," as recited in the '911 Patent, Claim 4
- "from a starting moment of the heating," as recited in the '540 Patent, Claim 8
- "a pressurization unit for pressurizing the air sucked from inside the tempering furnace," as recited in the '911 Patent, Claim 1
- "the temperature of the glass follows a predetermined heating curve," as recited in the '540 Patent, Claims 3, 12, 13, and 14
- "a control unit arranged to control the blowing of pressurized air," as recited in the '911 Patent, Claim 2

The court held a claim construction hearing on February 23, 2024, during which the parties addressed the contested terms. (Minute Entry 02/23/2024.) The dispute is thus submitted to the court and is ready for decision.

II. ANALYSIS

In total, the parties dispute the terms of eight claims, which can be grouped analytically into three categories: (1) terms that

require the court to engage in standard claim construction (i.e., each party submits a proposed construction); (2) terms that Salem argues are indefinite; and (3) terms that Salem argues are means-plus-function terms subject to the indefiniteness limitation of 35 U.S.C. § 112 ¶ 6 but Plaintiffs argue are structural terms not subject to such limitation. (See Docs. 32-2, 38, 40, 45, 46.) Each of these categories is governed by a different legal standard, and each will be addressed in turn below.

A. Standard Claim Construction

Claim construction is a question of law for the court. Markman v. Westview Instruments, Inc., 517 U.S. 370, 384, 389-91 (1996). The claims of a patent define the invention itself, establishing the metes and bounds of what is protected by law. Phillips v. AWH Corp., 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc). "The construction of claims," then, "is simply a way of elaborating the normally terse claim language in order to understand and explain, but not to change, the scope of the claims." Embrex, Inc. v. Serv. Eng'g Corp., 216 F.3d 1343, 1347 (Fed. Cir. 2000) (alterations and citation omitted); see U.S. Surgical Corp. v. Ethicon, Inc., 103 F.3d 1554, 1568 (Fed. Cir. 1997).

Claim terms should be construed according to the meaning they "would have to a person of ordinary skill in the art in question at the time of the invention" ("POSA"). Phillips, 415 at 1313.

Claim construction begins with the language of the claims themselves, Braintree Labs., Inc. v. Novel Labs., Inc., 749 F.3d 1349, 1354-55 (Fed. Cir. 2014) (citing Interactive Gift Express, Inc. v. CompuServe Inc., 256 F.3d 1323, 1331 (Fed. Cir. 2001)); Phillips, 415 at 1313-14, and the terms are generally given their ordinary and customary meaning as understood by a POSA at the time the patent application was filed. Phillips, 415 at 1312-13. When deciphering that meaning, courts "first look to, and primarily rely on, the intrinsic evidence, including the claims themselves, the specification, and the prosecution history of the patent[.]" Sunovion Pharms., Inc. v. Teva Pharms. USA, Inc., 731 F.3d 1271, 1276 (Fed. Cir. 2013) (citing Phillips, 415 F.3d at 1315; Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed. Cir. 1996)). The patent specification in particular "is always highly relevant to the claim construction analysis[,] and "[u]sually, it is dispositive; it is the single best guide to the meaning of a disputed term." Phillips, 415 F.3d at 1315 (quoting Vitronics, 90 F.3d at 1582). Beyond that, the prosecution history, which includes the record of proceedings before the Patent and Trademark Office, is also "often of critical significance in determining the meaning of the claims." Vitronics, 90 F.3d at 1582.

Where intrinsic evidence leaves the term open to either proposed construction, the court may then rely on "extrinsic evidence," which "consists of all evidence external to the patent

and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises.” Markman v. Westview Instruments, Inc., 52 F.3d 967, 980 (Fed. Cir. 1995), aff’d, 517 U.S. 370 (1996). However, although extrinsic evidence may be probative of a claim’s meaning, it is “less significant” and “less reliable” than intrinsic evidence. Phillips, 415 F.3d at 1317-18 (quoting C.R. Bard, Inc. v. U.S. Surgical Corp., 388 F.3d 858, 862 (Fed. Cir. 2004)). For example, the opinions of experts can be helpful in understanding how a POSA would understand a term, but they are less useful when they are simply “conclusory, unsupported” definitions, or when they contradict the intrinsic evidence. Id. at 1318. Expert testimony in particular must be viewed with caution because it is evidence “generated at the time of and for the purpose of litigation and thus can suffer from bias that is not present in intrinsic evidence.” Id. Moreover, this bias “can be exacerbated if the expert is not one of skill in the relevant art or if the expert’s opinion is offered in a form that is not subject to cross-examination.” Id. In the end, there is “no magic formula or catechism for conducting claim construction.” Id. at 1324. What matters is that the court “attach the appropriate weight” to the evidence from the various sources, acknowledging the value and limitations of each kind of evidence. Id.

In the present case, the parties submit only the following for standard claim construction: “sucking hot air from inside the

furnace.” (’540 Patent, Claim 1; ’911 Patent, Claim 1.) The court takes up that analysis below.

1. “sucking [hot] air from inside the [tempering] furnace”

Plaintiffs’ Construction	Defendant’s Construction
“creating a pressure differential to pull air at elevated temperature from inside the furnace” (Doc. 32-2 at 3.)	“moving hot air outside the furnace via a vacuum” (Doc. 32-2 at 3.)

Claim 1 of the ’540 Patent provides in full:

The invention claimed is:

1. In a method of heating glass, the method comprising conveying glass through a tempering furnace during a heating cycle so that the glass is heated from above and below, the improvements consisting essentially of

heating an upper surface of the glass by hot air jets formed by sucking hot air from inside the furnace, pressurizing the hot air and recycling the pressurized hot air back to the upper surface of the glass for the heating from above, and

blowing air which has been taken from outside the furnace and which has been pressurized by a compressor and heated onto a lower surface of the glass for the heating from below.

(’540 Patent at Claim 1 (emphasis added).) Similarly, Claim 1 of the ’911 provides in full:

The invention claimed is:

1. An apparatus for heating glass, the apparatus comprising a tempering furnace comprising horizontal rolls arranged to carry the glass and to form a

conveyor thereof, an upper side return pipe for sucking air from inside the tempering furnace, a pressurization unit for pressurizing the air sucked from inside the tempering furnace, means for blowing the pressurized air back to an upper surface of the glass, a compressor for pressurizing air taken from outside the furnace, a pipe system for conveying the air pressurized by the compressor to a lower surface of the glass, and means for heating the air pressurized by the compressor.

('911 Patent at Claim 1 (emphasis added).) The parties dispute the meaning of the term "sucking [hot] air from inside the [tempering] furnace" in both phrases. (Doc. 32-2 at 3.)

At the core of the dispute is whether the air must move outside the furnace before being returned to heat the top surface of the glass. The parties agree that the claim term involves the working of some form of pressure differential⁵ to create the movement of air and that this air must be at an elevated temperature. (Docs. 38 at 19-20; Doc. 40 at 21.) However, the parties disagree as to the path the air flow must take, which hinges on the interpretation of the word "from" in the claim term.

Salem contends that "from" indicates a pathway of flow that begins "inside the furnace" and proceeds by moving the hot air

⁵ Salem characterizes this pressure differential as a "vacuum" and contends this is consistent with Plaintiffs' presentation of the term in the specification and in their proposed construction. (Doc. 38 at 19-20.) Plaintiffs do not specifically refute the "vacuum" characterization in their briefing, nor did they do so at oral argument. However, Plaintiffs also did not specifically concede this point, so to avoid overstating the extent to which the parties agree, the court uses the broader term "pressure differential," which encompasses the narrower term "vacuum."

outside the furnace. (Doc. 38 at 18.) As intrinsic support for this construction, Salem points to Figure 1 of both patents:

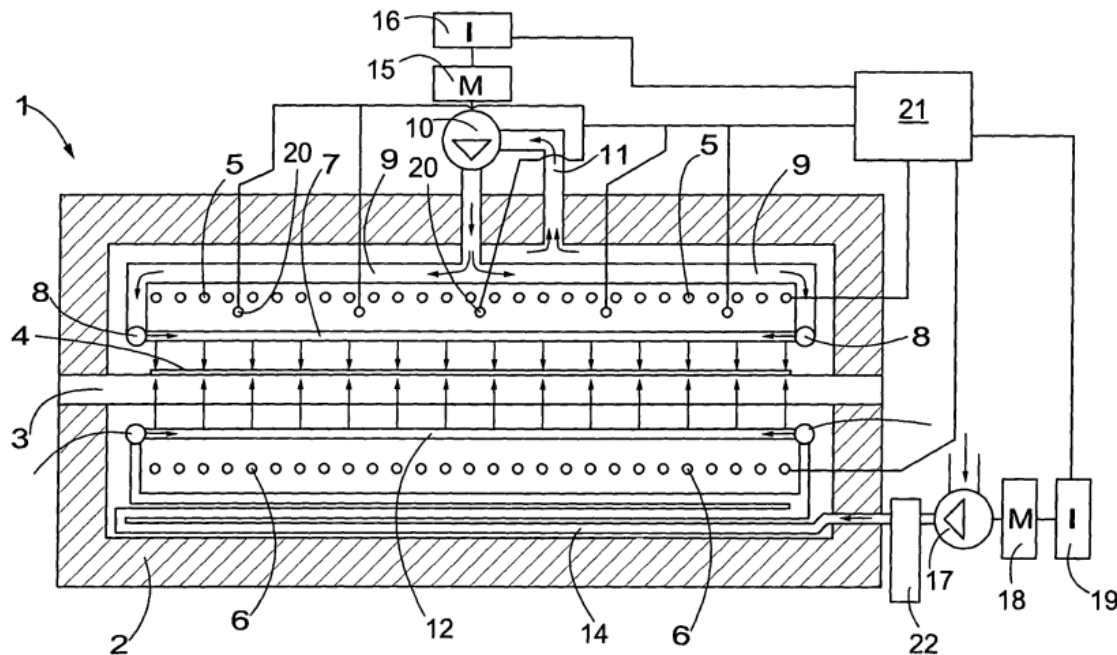


FIG. 1

('540 Patent at Fig. 1.) Specifically, Salem notes the depiction of air moving from the body of the furnace [2] to a pressurization unit [10] located outside that body through the upper side return pipe [11], and it points to the corresponding description in the specification for how the pressurization unit [10] sucks air "from at least one point inside the furnace," but "[p]referably . . . from a middle line of the furnace 1 at the ceiling of the furnace and from both ends of the furnace" through the pipe [11]. (*Id.* at 18-19 (citing '540 Patent at 3:49-51).) According to Salem:

In all embodiments, the air being sucked from the inside of the furnace is being sent to a location different

from the location it was sucked from Thus, a [POSA] would understand from the specification that 'from' not only describes the origin of the hot air, but also the intended direction of the hot air.

(Id. at 20 (emphasis in original).) Salem further alleges that this construction is consistent with the historical record, specifically the Vehmas patent that is cross-referenced multiple times in the '540 and '911 patents. (Id. at 20-21.) In terms of extrinsic support, Salem relies primarily on the testimony of Mr. Lee Fackelman, a "semi-retired" mechanical engineer with a B.S. and master's degree in mechanical engineering and nearly 40 years' experience in the glass tempering industry (Doc. 40-12 at 4,5), and whom Plaintiffs do not appear to challenge is qualified to testify as to what a person skilled in the art for purposes of this case would have known (Cf. Doc. 40 at 18-19 (attacking Mr. Fackelman's credibility without disputing his credentials or experience).). Mr. Fackelman opines that "sucking" a fluid such as air cannot occur within the same container and concludes, based on the specification and prior art references, that a POSA would understand the claim term to necessitate movement outside the furnace. (Doc. 32-3 ¶¶ 80-85.) That testimony is consistent, Salem argues, with several dictionary definitions of "from" that indicate that the term entails a separation, a fact which its proposed definition recognizes. (Id. at 22 (citing Docs. 38-5, 38-7, 38-8.)) Finally, Salem argues that Plaintiffs disclaimed any

broader meaning for "from inside the furnace" in their opposition to the petition for *inter partes* review, where they emphasized the movement of air outside of the furnace as required. (Id. at 22 (citing Doc. 39-11 at 31-32).) For all these reasons, Salem argues that its proposed construction, which limits the scope of the term to instances where air moves outside the furnace, is correct and should be adopted.

According to Plaintiffs, "from" merely indicates the origin or source of the air, and coverage is not limited to instances where air moves outside the furnace. (Doc. 40 at 21.) Contrary to Salem's position, Plaintiffs note that the source and the destination of the air are both clearly defined in the patent as written: the air must come from the inside of the furnace and go to the upper surface of the glass for heating from above. (Id. at 21-22.) Plaintiffs argue that neither the claims nor the specifications require that the air be moved outside as it travels between that source and the destination, and adding such a requirement is contrary to the history of the patent and its prosecution. (Id. at 23 ("During prosecution, applicants repeatedly distinguished over prior art showing the use of fresh compressed air for the upper convection heating, stating '[u]pper heating by sucking air from inside the furnace is, therefore contrary to the [Vitkala reference] and its combination with any reference, even that of Vehmas.'" (internal citation omitted).))

Plaintiffs contend, moreover, that they never disclaimed devices that retain air within the furnace in their patent or during prosecution; on the contrary, they specifically asserted that “the drawings and the description are illustrations of the invention and details may vary within the scope of the claims.” (Doc. 46 at 13-14 (citing ‘540 Patent at 5:47-49).)

Plaintiffs argue that their construction more faithfully represents the actual meaning of the claim term. They point out that the word “from” throughout the patent and specification is used to designate the source or origin, making their construction more consistent with evidence internal to the patent. (Id. at 21-22 (citing ‘540 Patent at 3:49-54, 4:34-35).) Plaintiffs also claim their construction is similarly consistent with Figure 1, as structural unit [1] indicates the whole of the furnace and encompasses the pressurization unit [10].⁶ (Doc. 46 at 12-13.) And as Plaintiffs noted at oral argument, the patent elsewhere denotes instances when air must be moved or taken from outside the furnace, as it does with the bottom-side heating, which invites the inference that this term should not be interpreted in the same way. (Doc. 89 at 11 (“In fact, if the patentees had intended to say that upper side air should be taken outside the furnace, they

⁶ Plaintiffs alternatively argue that even if Figure 1 supports Salem’s construction, it is but one embodiment of the claimed invention meant to demonstrate, but not limit, how the patent may be executed. (Doc. 46 at 13.)

would have done it. In fact, they did do it elsewhere in the claim. For the bottom side blowing, the claim says the air is taken from outside the furnace. Because the same claim recites both inside the furnace and outside the furnace, they are presumed to have different meanings."").) Thus, Plaintiffs argue, their proposed construction better represents the term in the patent and should be selected.

Plaintiffs' proposed construction indeed better presents the claim term in a way that helps "explain, but not . . . change, the scope of the claims" at issue. Embrex, 216 F.3d at 1347 (alterations and citation omitted). As Plaintiffs point out, the patent defines a source for the air – "inside the furnace" – and a destination for it – "the upper surface of the glass" – and the patent states that the air must be pressurized between these two points. (See '540 Patent at 2:13-16.) However, the patent says nothing of a specific path the air must take to carry out that process between those points. In this sense, Salem's proposed construction adds a prerequisite to what actually appears on the face of the patent by inserting the requirement that the air move outside the furnace in order to narrow the patent's scope. But the critical feature the claim intends to protect is the source of the air, which is specified to be "from inside the furnace" for top-side heating as opposed to "from outside the furnace" for bottom-side hearing, and not the path through which it travels.

('540 Patent at Claim 1.) Indeed, the path through which the air travels seems to be of no obvious importance to the operation of the invention.⁷ On the other hand, "from" is used repeatedly throughout the specification to denote origin. (See '540 Patent at 3:49-54, 4:34-35.) A POSA reading the claims in light of the specification and patent history would therefore understand the feature protected by the term "sucking hot air from inside the furnace" to be the use of air that is recycled from inside the furnace, not the route through which it travels. Plaintiffs' construction is thus more appropriate than Salem's.

Moreover, Salem's arguments concerning Figure 1 and Plaintiffs' disclaimer are unavailing. Even assuming Figure 1 shows air traveling outside the furnace, as Salem proffers (Doc. 38 at 19), the Federal Circuit "has expressly rejected the contention that if a patent describes only a single embodiment, the claims of the patent must be construed as being limited to that embodiment." Liebel-Flarsheim Co. v. Medrad, Inc., 358 F.3d 898, 906 (Fed. Cir. 2004) (citing ACTV, Inc. v. Walt Disney Co., 346 F.3d 1082, 1091 (Fed. Cir. 2003); Apex Inc. v. Raritan Comput.,

⁷ Salem has argued, through the testimony of Mr. Fackelman and at oral argument, that the separation cannot be within the same container - here, the inside of the furnace - which makes specification of the path implicit and necessary to recite. (Doc. 32-3 at ¶ 80.) However, at no point does Salem provide any reasoning to support that conclusion. When considered alongside the fact that Mr. Fackelman never reviewed the patent prosecution history (Doc. 40-11 at 51, 57-58, 75), this argument is unpersuasive.

Inc., 325 F.3d 1364, 1377 (Fed. Cir. 2003); Altiris, Inc. v. Symantec Corp., 318 F.3d 1363, 1373 (Fed. Cir. 2003); Tex. Digit. Sys., Inc. v. Telegenix, Inc., 308 F.3d 1193, 1204-05 (Fed. Cir. 2002); Teleflex, Inc. v. Ficosa N. Am. Corp., 299 F.3d 1313, 1327 (Fed. Cir. 2002); SRI Int'l v. Matsushita Elec. Corp. of Am., 775 F.2d 1107, 1121 n. 14 (Fed. Cir. 1985) (en banc)). It is only when "the patentee has demonstrated a clear intention to limit the claim scope using 'words or expressions of manifest exclusion or restriction'" that courts should interpret patents to be narrowed to the single embodiment described or depicted. Id. (quoting Teleflex, 299 F.3d at 1327). As already noted, no other part of the patent or its history reflects an intent to limit the pathway through which air from inside the furnace must travel. Therefore, Salem's argument falls short of supporting its construction even if the court accepts its interpretation of the figure.

Salem's disclaimer argument fails for a similar reason: the Federal Circuit has made clear that a disavowal requires "expressions of manifest exclusion or restriction, representing a clear disavowal of claim scope." Epistar Corp. v. Int'l Trade Comm'n, 566 F.3d 1321, 1335 (Fed. Cir. 2009) (quoting Teleflex, 299 F.3d at 1325). As Plaintiffs point out, nowhere in the patent, the patent prosecution history, or their response to *inter partes* review do they engage in such a disavowal. (Doc. 46 at 13-14). In fact, the marked-up diagram that Salem cites as evidence of

Plaintiffs' disclaimer in their *inter partes* review response only serves to bolster Plaintiffs' argument that what is actually critical is the distinction between air taken from inside the furnace for upper-side heating and air taken from outside the furnace for lower-side heating. (Doc. 39-11 at 31-32.) Therefore, Salem's arguments fail to support its position.

For these reasons, the court rejects Salem's proposed construction and adopts Plaintiffs' construction for the term "sucking [hot] air from inside the furnace" as it appears in Claim 1 of the '540 and the '911 Patents. The term thus means "creating a pressure differential to pull air at elevated temperature from inside the furnace." (Doc. 32-2 at 3.)

B. Indefiniteness

Salem challenges the majority of the disputed terms as being indefinite. A patent claim is invalid for indefiniteness under 35 U.S.C. § 112 "if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." Nautilus, Inc. v. Biosig Instruments, Inc., 572 U.S. 898, 901 (2014). "The definiteness requirement 'mandates clarity, while recognizing that absolute precision is unattainable.'" Presidio Components, Inc. v. Am. Tech. Ceramics Corp., 875 F.3d 1369, 1375 (Fed. Cir. 2017) (quoting Nautilus, 572 U.S. at 910). In other words, "[t]he definiteness requirement

must take into account the inherent limitations of language, but at the same time, the patent must be precise enough to afford clear notice of what is claimed, thereby apprising the public of what is still open to them.” Fairfield Indus., Inc. v. Wireless Seismic, Inc., No. 4:14-CV-2972, 2015 WL 1034275, at *4 (S.D. Tex. Mar. 10, 2015) (citing Nautilus, 572 U.S. at 907-911). As with claim construction, the question of indefiniteness is a legal one for the court to evaluate. Young v. Lumenis, Inc., 492 F.3d 1336, 1344 (Fed. Cir. 2007) ; ePlus, Inc. v. Larson Software, Inc., 700 F.3d 509, 517 (Fed. Cir. 2012) (“[I]ndefiniteness is a question of law and in effect part of claim construction.”).

A key difference between claim construction and indefiniteness inquiries, however, relates to burden of proof. Under § 282 of the Patent Act of 1952, 35 U.S.C. § 282, a patent is “presumed valid,” and the burden of proving invalidity for indefiniteness rests on the party asserting such invalidity. 35 U.S.C. § 282(a); see Microsoft Corp. v. I4I Ltd. P’ship, 564 U.S. 91, 95 (2011); Takeda Pharm. Co. v. Zydus Pharms. USA, Inc., 743 F.3d 1359, 1366 (Fed. Cir. 2014). The challenger must prove invalidity by clear and convincing evidence. Microsoft Corp., 564 U.S. at 95; Takeda Pharm. Co., 743 F.3d at 1366.

Originally, the parties disputed whether the case is ripe for adjudication of the indefiniteness issue. In the joint claim construction brief, Plaintiffs argued that an indefiniteness

challenge at the claim construction stage would be premature, noting that fact discovery was underway and the record was undeveloped. (Doc. 32 at 3-5.) Plaintiffs reiterated this belief in their opening claim construction brief. (Doc. 40 at 18-20.) Defendants contended that the indefiniteness inquiry is proper at this stage, citing case law finding that the indefiniteness question is “part of claim construction.” (Doc. 32 at 7 (citing ePlus, Inc., 700 F.3d at 517; Ultra-Mek, Inc. v. United Furniture Indus., Inc., Case No. 1:18CV281, 2019 WL 4723351, at *4-5 (M.D.N.C. Sept. 9, 2019); Workshare Tech., Inc. v. Litera Techs., LLC, No. 1:11CV285, 2013 WL 1314595, at *3 (M.D.N.C. Mar. 28, 2013); Volumetrics Med. Imaging, LLC v. Toshiba Am. Med. Sys., Inc., No. 1:05CV00955, 2011 WL 6934603, at *5-6 (M.D.N.C. Dec. 30, 2011); Akeva L.L.C. v. Adidas Am., Inc., No. 1:03CV01207, 2005 WL 6225278, at *20-21 (M.D.N.C. May 17, 2005)).)

Whatever merit there may have been to Plaintiffs’ procedural argument, Plaintiffs do not dispute that the record now sits in a different posture. (Doc. 89 at 34.) Fact discovery is closed, expert testimony for claim construction has been submitted to the court, and there is no additional evidence either party intends to bring forth on the issue of indefiniteness. (Id.) Based on this posture and these representations, the court finds that consideration of Salem’s indefiniteness arguments is appropriate at this time.

Salem maintains that five terms are indefinite, thus rendering the patent invalid: "the improvements consisting essentially of" ('540 Patent at Claim 1); "controlled in a forced manner . . . in accordance with a heating profile" ('540 Patent at Claims 3, 12, 13, 14) and "heat, using forced control . . . in accordance with a heating profile" ('911 Patent at Claim 4)⁸; "the temperature of the glass follows a predetermined heating curve" ('540 Patent at Claims 3, 12, 13, 14); and "from a starting moment of the heating" ('540 Patent at Claim 8). Salem raises only indefiniteness challenges to these terms and does not provide alternative constructions to those proposed by Plaintiffs. Accordingly, each claim term will be considered below.

1. "the improvements consisting essentially of"

Plaintiffs' Construction	Defendant's Construction
Permits the inclusion of components or steps not listed in the claim, provided they do not materially affect the basis and novel properties of the invention. (Doc. 32-2 at 1.)	Indefinite (Doc. 32-2 at 1.)

The term "the improvements consisting essentially of," which

⁸ The parties represent that these terms are functional equivalents of one another in the two patents, that they raise the same arguments for and against invalidity, and that they can be considered together by the court. (See Doc. 89 at 78, 79; see also Docs. 38, 40 (addressing the two claim terms together in the same subsection of the briefs).)

appears in Claim 1 of the '540 Patent,⁹ is a transitory term that both parties agree represents the middle ground between the open-ended transitory term "comprising" and the closed-ended transitory term "consisting of." (See Doc. 38 at 9; Doc. 40 at 7-8.) The phrase "consisting essentially of" in a patent permits the inclusion of components not listed in the claim that do not materially affect the basic and novel properties of the invention. AK Steel Corp. v. Sollac & Ugine, 344 F.3d 1234, 1239 (Fed. Cir. 2003). The parties' central dispute over this term is whether the basic and novel properties anticipated by the '540 Patent are sufficiently definite to be instructive, or whether they are indefinite, thus rendering the entire patent invalid.

Salem argues that the term is indefinite because the basic and novel properties of the invention are indefinite such that a POSA would not know whether additional components he or she was contemplating were infringing. Relying on the testimony of Mr. Fackelman, Salem claims the '540 Patent's specification identifies five basic and novel properties recognizable to a POSA: (1) heating selective glass "reasonably quickly"; (2) a "reasonably simple" apparatus; (3) heating coated glass in a "controlled manner"; (4) achieving "quite a high heating rate"; and (5) keeping the temperature of the bottom of the furnace "quite low" during a

⁹ The full text of Claim 1 is laid out in the previous section.

continuous load situation. (Doc. 38 at 10 (citing Doc. 32-2 ¶ 42).) According to Salem, each of these properties is somehow “comparative” in nature (i.e., a term of degree), and where that is true, Federal Circuit “case law is clear that the objective boundaries requirement applies to terms of degree.” (Id. (quoting Berkheimer v. HP Inc., 881 F.3d 1360, 1364 (Fed. Cir. 2018)).) Salem argues that neither the specification nor the prosecution history provides a POSA with any such objective method for evaluating whether any one of the properties has been altered, much less materially altered. (Id. at 10-11.) Therefore, because “a [POSA] cannot ascertain the bounds of the basic and novel properties of the invention,” Salem concludes, Claim 1 and the terms that flow from it should be deemed indefinite, and the patent should be declared invalid. (Id. (citing HZNP Meds. LLC v. Actavis Lab’ys UT, Inc., 940 F.3d 680, 696 (Fed. Cir. 2019); Energizer Holdings, Inc. v. Int’l Trade Comm’n, 435 F.3d 1366, 1369 (Fed. Cir. 2006)).)

Plaintiffs dispute Salem’s arguments for indefiniteness on several grounds. First, they note that Salem’s analysis conflates the basic and novel properties of the invention with the basic and novel advantages of the invention conferred by those properties. (Doc. 46 at 5.) According to Plaintiffs, the characteristics identified by Mr. Fackelman are not the basic and novel properties of the invention. (Id.) Instead, Plaintiffs assert the basic and

novel properties are illuminated via the use of Jepson¹⁰ claiming, which is a form of historically recognized patent recitation that contains a preamble followed by a transition phrase such as "comprising" or "consisting essentially of" and concludes with the novel improvements over the prior art. (Doc. 40 at 8.) Here, those properties are: (1) heating the upper surface of the glass with recycled hot air from the furnace, and (2) blowing pressurized air from outside the furnace on the lower surface of the glass. ('540 Patent at Claim 1.) Plaintiffs argue that the specification supports the reading that these are the basic and novel properties of the invention, while the specification points to the "features" identified by Mr. Fackelman only as advantages or improvements that flow from the "heating" and "blowing" Plaintiffs identified. (Compare '540 Patent at 2:11-20 ("The idea underlying the invention is that . . . [t]he upper surface of the glass is heated by hot

¹⁰ Jepson claiming originally arose out of Ex Parte Jepson, 243 O.G. 525 (Ass't Comm'r Pat 1917). The practice has since been codified:

Where the nature of the case admits, as in the case of an improvement, any independent claim should contain in the following order, (1) a preamble comprising a general description of all the elements or steps of the claimed combination which are conventional or known, (2) a phrase such as "wherein the improvement comprises," and (3) those elements, steps and/or relationships which constitute that portion of the claimed combination which the applicant considers as the new or improved portion.

37 C.F.R. § 1.75(e). It continues to be recognized as a commonplace practice in patent cases. See, e.g., Ethicon Endo-Surgery, Inc. v. U.S. Surgical Corp., 93 F.3d 1572, 1577 (Fed. Cir. 1996) (noting that in a Jepson claim, "the inventive portion of the claim must lie in the clause beginning: 'the improvement comprising'").

air jets formed by sucking air from inside the furnace and pressurizing the hot air and recycling it back to the upper surface of the glass. Furthermore, air which has been taken from outside the furnace and which has been pressurized by a compressor and heated is blown to the lower surface of the glass."), 3:8-65 (describing structures for heating the upper side of the glass by pressurizing air recirculated from the upper side of the furnace), 3:66-4:46 (describing structures for heating the lower surface of the glass by pressurized air taken from outside the furnace), with id. at 2:32-46 (stating that the advantages of the invention conferred by the basic and novel features of the claimed method include a reasonably quick heating of glass, a reasonably simple apparatus, achieving a high heating rate and keeping the temperature of the bottom of the furnace quite low).)

Plaintiffs likewise argue that Salem's contention ignores the prosecution history of the patent, in which the '540 Patent was repeatedly distinguished over prior art based on the combination of the "heating" and "blowing" features. Plaintiffs note that the prosecution history in several instances focused on the combination of heated, recirculated air for top-side heating and blown, outside air for bottom-side heating as the basis for the invention's novelty and non-obviousness. (See, e.g., Doc. 40-3 at 273 ("[T]he rejection for obviousness under 35 USC 103 is traversed by the teaching in Vitkala of fresh compressed air for both the

upper and lower convection heating. Upper heating by sucking air from inside the furnace is, therefore[,] contrary to [Vitkala]”), 299 (“[T]he Vitkala publication teaches supplying air from outside the furnace to heat both the upper and lower faces of the glass. This is directly contrary to claim 1, which requires the heating of the upper surface to consist essentially of air from inside the furnace.”), 330 (“[T]he alternatives of recirculation of either the upper or the lower convection blast stream while using nonrecirculated blast stream on the opposite glass surface are not any ‘alternatives’ of existing prior art but a new and unexpected combination.”), 464 (demonstrating that the Board of Appeals specifically found that it was not obvious to recirculate furnace air to heat the top of the glass based on prior art showing the use of outside air to heat the top of the glass).) Meanwhile, Plaintiffs point out that Mr. Fackelman’s testimony is unsupported by the prosecution history, as by his own admission he did not consider or review the historical record when expressing opinions on the patent. (See, e.g., Doc. 40-11 at 51 (“I don’t think the prosecution histories affected me at all because I browsed them quickly and I – the opinions that I have are based entirely on the information about legal standards that counsel has taught me and the patents themselves.”), 57-58 (“I didn’t study those big prosecution histories and they’re the only prosecution histories I have ever seen at all. . . . I don’t have any details or opinions

relating to the prosecution histories because I didn't hardly pay any attention to them."), 75 ("I paid very little attention to that prosecution history.").

Finally, Plaintiffs argue that Salem previously agreed with their proposed construction on this term, and the Patent and Trademark Appeals Board ("PTAB") therefore found that Plaintiffs' construction prevailed. Plaintiffs point to Mr. Fackelman's deposition (Doc. 40-11 at 66) as well as Salem's petition to the PTAB acknowledging the disputed claim term (Doc. 40-9 at 19-20) as evidence to support this contention. Salem argues in response, however, that the transition phrase was not in dispute before the PTAB and that any of Salem's prior statements about its understanding of the patent are not evidence here as to its meaning, rendering this argument unpersuasive. (Doc. 45 at 8.) Instead, Salem maintains that even in its opening brief, it asserted the five basic and novel properties it asserts in its claim construction briefing, and those should be found to control here. (Id.)

As an initial matter, Salem is correct that the proceedings before the PTAB are not instructive on this issue. The PTAB considers only questions of novelty and non-obviousness as part of *inter partes* review, Inter Partes Review, U.S. Pat. & Trademark Off., <https://www.uspto.gov/patents/ptab/trials/inter-partes-review> (last visited Apr. 8, 2024), and the question of

indefiniteness of the term "the improvements consisting essentially of" was not contested or considered.

Nevertheless, Salem has failed to show by clear and convincing evidence that the term is indefinite and that the patent is therefore invalid. Salem rests its entire argument on the testimony of Mr. Fackelman, yet his testimony suffers all of the credibility¹¹ issues that Plaintiffs point out. Mr. Fackelman's failure to review the full history of the patent, which can be critical to the understanding of its meaning, Vitronics, 90 F.3d at 1582, coupled with his own testimony that his opinions come from Salem's counsel's legal teachings, casts serious doubt on his ability to provide reliable testimony as to the understanding of these terms - and it is not enough on its own to constitute clear and convincing evidence. Meanwhile, Plaintiffs offer more than sufficient evidence not only to rebut Salem's position but to find affirmatively that the patent should be interpreted as a Jepson claim with the "heating" and "blowing" steps being the basic and novel properties of the invention.

Therefore, the court holds that the term "the improvements consisting essentially of" is sufficiently definite. As a result,

¹¹ District courts at the claim construction stage are authorized to make credibility determinations, even on a written record of expert testimony. Teva Pharms., 574 U.S. at 325-327. Here, the court has reviewed the deposition transcripts and expert declarations provided to it, and it has assessed the experts' credibility in accordance with its power to make subsidiary factual determinations that support its legal analysis.

Plaintiffs' construction prevails, and the term will be understood to include components or steps not listed in the claim so long as they do not materially alter the "heating" and "blowing" properties listed.

2. "controlled in a forced manner . . . in accordance with a heating profile" and "heat, using forced control . . . in accordance with a heating profile"

Plaintiffs' Construction	Defendant's Construction
"controlled to heat at a power level in accordance with a heating profile" (Doc. 32-2 at 4.)	Indefinite (Doc. 32-2 at 4.)

Plaintiffs' Construction	Defendant's Construction
"heat at a power level in accordance with a heating profile" (Doc. 32-2 at 6.)	Indefinite (Doc. 32-2 at 6.)

The term "controlled in a forced manner . . . in accordance with a heating profile" appears in several terms in the '540 Patent. It first appears in Claim 3, which states in full:

3. A method as claimed in claim 2, wherein during the blowing on the underside, the underside is heated by the electric resistors controlled in a forced manner so as to heat at a power level in accordance with a heating profile, and during the rest of a heating cycle, the electric resistors are controlled by thermoelements such that the temperature of the glass follows a predetermined heating curve.

('540 Patent at Claim 3 (emphasis added).) It next appears in

Claim 12, which states in full:

12. A method as claimed in claim 11,

wherein the lower surface of the glass is heated from below by means of electric resistors, and when the blowing on the underside starts, heating effect given by the electric resistors is increased,

wherein during the blowing on the underside, the underside is heated by the electric resistors controlled in a forced manner so as to heat at a power level in accordance with a heating profile, and during the rest of a heating cycle, the electric resistors are controlled by thermoelements such that the temperature of the glass follows a predetermined heating curve,

wherein the blowing on the underside ends before the heating cycle ends, and lasts maximally for 60% of the heating cycle, and

wherein the blowing on the underside ends no later than at 80% of the heating cycle.

('540 Patent at Claim 12 (emphasis added).) It also appears in

Claim 13 immediately following, which states in full:

13. A method as claimed in claim 10,

wherein the lower surface of the glass is heated from below by means of electric resistors, and when the blowing on the underside starts, heating effect given by the electric resistors is increased,

wherein during the blowing on the underside, the underside is heated by the electric resistors controlled in a forced manner so as to heat at a power level in accordance with a heating profile, and during the rest of a heating cycle, the electric resistors are controlled by thermoelements such that the temperature of the glass follows a predetermined heating curve,

wherein the blowing on the underside ends before the heating cycle ends, and lasts maximally for 60% of

the heating cycle, and

wherein the blowing on the underside ends no later than at 80% of the heating cycle.

('540 Patent at Claim 13 (emphasis added).) Finally, it appears in Claim 14, which states in full:

14. A method as claimed in claim 1,

wherein the lower surface of the glass is heated from below by means of electric resistors, and when the blowing on the underside starts, heating effect given by the electric resistors is increased,

wherein during the blowing on the underside, the underside is heated by the electric resistors controlled in a forced manner so as to heat at a power level in accordance with a heating profile, and during the rest of a heating cycle, the electric resistors are controlled by thermoelements such that the temperature of the glass follows a predetermined heating curve,

wherein the blowing on the underside ends before the heating cycle ends, and lasts maximally for 60% of the heating cycle, and

wherein the blowing on the underside ends no later than at 80% of the heating cycle.

('540 Patent at Claim 14 (emphasis added).)

The related term "heat, using forced control . . . in accordance with a heating profile" appears only once in Claim 4 of the '911 Patent, which states in full:

4. An apparatus as claimed in claim 3, wherein the control unit is arranged to control the lower electric resistors to heat, using forced control, at a power level in accordance with a heating profile simultaneously with the blowing of pressurized air on the lower surface of the glass

('911 Patent at Claim 4 (emphasis added).)

As noted, the parties represented to the court that both of these terms can be considered together. (Doc. 89 at 78-79.) As with the other terms, Salem contends that they are indefinite, while Plaintiffs provide a proposed construction and contend they are sufficiently definite to be valid.

Salem contends that these terms are indefinite because they fail to provide a POSA with sufficient detail to know whether he is infringing on the protected heating processes. Salem posits that when a claim "requires that an artisan make a separate infringement determination for every set of circumstances in which the composition may be used, and when such determinations are likely to result in differing outcomes (sometimes infringing and sometimes not), that construction is likely to be indefinite." (Doc. 38 at 14 (quoting Halliburton Energy Servs., Inc. v. M-I LLC, 514 F.3d 1244, 1254-55 (Fed. Cir. 2008)).) Here, Salem argues that heating glass "according to a heating profile" and using "forced control" are distinct processes, but the patents fail to provide direction to a POSA how to do both simultaneously. (Id. at 13.) Salem further contends that the patents' single description of a heating profile is inconsistent with how a POSA would have understood a heating profile under the prior art. (Id. (citing '540 Patent at 4:65-5:2).) Moreover, per the testimony of Mr. Fackelman, Salem argues that invocation of both a heating

profile and forced control, which are two different ways to heat glass, creates ambiguity and difficulty for a POSA, especially without a recipe for a particular heating profile. (Id. (citing Doc. 32-3 ¶¶ 49-52).) Given that a wide variety of factors such as glass size, composition, thickness, and ambient environmental factors would impact whether a certain "heating profile" would properly heat a particular piece of glass "using forced control," Salem argues, the specification provides insufficient detail to teach a POSA to heat glass using forced control in accordance with a heating profile in different circumstances. (Id. at 13-14.) Therefore, it concludes, the term should be invalidated for indefiniteness.

Plaintiffs deny that the patent provides insufficient detail on this point. According to Plaintiffs, the patents' specifications provide clear descriptions that distinguish between heating based on a heating profile and heating based on the control of a thermoelement, and the claimed term language here clearly refers to the former. (See '540 Patent at 4:49-5:46; '911 Patent at 4:55-61, 5:1-3, 5:12-20.) In addition, Plaintiffs note that the specifications and patent prosecution histories' references to the Vehmas Patent provide further instruction for a POSA seeking to understand how this method and apparatus operate. (See Doc. 40-3 at 72 (explaining that "[w]hat is known as a heating profile can be created for the furnace by means of electric resistors,

convection blowing having at the same time enabled the raising of the furnace capacity”), 77-78 (noting that the Vehmas Reference adds that “when the glass 4 arrives in the furnace, the upper resistors 5 are on according to a predefined heating profile”).) As Plaintiffs point out, Salem’s expert Mr. Renald Bartoe¹² at the *inter partes* review stage previously represented his opinion that a POSA would have understood what a heating profile was based on the information provided; that he or she would need to vary the heating profile’s parameters across various dimensions based on the type, size, and thickness of the glass to be tempered; and generally how to make those variations. (Doc. 40 at 12-13 (citing Doc. 40-5 ¶ 128).) While Plaintiffs concede Salem’s point that the patents do not provide specific recipes for heating, they contend they do not need to, as it is enough that a POSA would know he needed a recipe and could determine one based on his experience with the prior art. (*Id.* at 13 (citing In re Buchner, 929 F.2d 660, 661 (Fed. Cir. 1991); Hybritech, Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1384 (Fed. Cir. 1986).)) Thus, Plaintiffs contend, the term should not be deemed indefinite and their proposed construction should control.

¹² Mr. Bartoe holds a B.S. in biochemistry and, like Mr. Fackelman, has over 40 years’ experience in the glass tempering and ceramics industry. (Doc. 40-5 at 10-17.) Plaintiffs accept him as having expert qualifications to offer opinions on the glass tempering industry and what a POSA would have understood. (*Cf.* Doc. 40 at 18-19 (comparing Mr. Bartoe’s findings against Mr. Fackelman’s while assuming both of their qualifications in the industry to offer such findings).)

Salem again has not shown by clear and convincing evidence that these terms are indefinite. Apart from the problems already raised with relying on the testimony of Mr. Fackelman, Salem's arguments misconstrue the actual protections of the patents. Though Salem acknowledged at oral argument that the patent did not need to be tailored to a specific type of glass, it also asserted that in order for these terms to be definite, some specific heating profiles would need to be disclosed on the face of the patent. (Doc. 89 at 80, 83-86.) As Plaintiffs pointed out, this misunderstands what the patents actually seek to protect: it is not the specific recipes (of which there would be scores, depending on the type and application of the glass) that matter here, but whether a POSA would know it needed to use some recipe to heat the glass in accordance with the method recited and how to go about determining what that recipe would be. (See id. at 88 ("These claims and these patents aren't directed to recipes for specific kinds of glass. They are not directed to individual heating profiles for particular glass tempering applications. This patent does not need to provide a thousand different recipes or heating profiles in order to support these claims.")).) There is ample evidence in the record to suggest that a POSA would understand this fact. The prosecution history and Salem's own Mr. Bartoe point out that the practice of creating heating profiles and the variables to consider are already established under the prior

art — specifically the Vehmas patent — such that a POSA would have sufficient knowledge to understand the terms here. (Doc. 40-3 at 72, 77-78; Doc. 40-5 ¶ 128.) While Salem argued that it would take a person of greater than ordinary skill in the art to know how to do this (Doc. 89 at 82), this blanket assertion without additional support is not enough to carry the burden of showing indefiniteness by clear and convincing evidence, and Mr. Fackelman's testimony likewise does not suffice to cross that hurdle. Therefore, Salem has not shown that either of these terms is indefinite and thus invalid as a matter of law.

Having reviewed Plaintiffs' constructions for both terms, the court adopts them. The term "controlled in a forced manner . . . in accordance with a heating profile," as it appears in the '540 Patent, Claims 3, 12, 13, and 14, will be construed to mean "controlled to heat at a power level in accordance with a heating profile." (Doc. 32-2 at 4.) The term "heat, using forced control . . . in accordance with a heating profile," as it appears in the '911 Patent, Claim 4, will be construed to mean "heat at a power level in accordance with a heating profile." (Doc. 32-2 at 6.)

15. "the temperature of the glass follows a predetermined heating curve"

Plaintiffs' Construction	Defendant's Construction
"the temperature of the glass follows a heating curve determined beforehand" (Doc. 32-2 at 10.)	Indefinite (Doc. 32-2 at 10.)

Salem raises a near identical dispute over the term "the temperature of the glass follows a predetermined heating curve" as it does over the prior two terms.¹³ Salem does not address the term separately and instead combines its arguments for the prior two terms with this one. (See Doc. 38 at 12-15.) In essence, it argues that "predetermined heating curve" is also indefinite because there are no specific instructions for what to consider or how to calculate the heating curve, and without these boundaries, a POSA would have no understanding of when he was infringing. (See Doc. 89 at 86-88.) It again offers the testimony of Mr. Fackelman and supporting case law to support this contention. (Doc. 38 at 12-15 (citing Doc. 32-3 ¶¶ 55, 57).) Plaintiffs respond by noting that the important term of limitation is that the curve must be "predetermined," or set beforehand, and so long as a POSA engaged in the well-understood process of calculating a heating curve based on the variables of the specific glass beforehand, he or she would

¹³ This term likewise appears in Claims 3, 12, 13, and 14 of the '540 Patent, which are recited in full above.

be infringing. (Doc. 40 at 13-15.) This is sufficiently clear on the face of the patent, Plaintiffs contend, and they argue that the term is therefore not indefinite for the same reasons as above.

The court agrees with Plaintiffs. As with the prior two terms, the court here finds that Salem has not met its burden to demonstrate that the term is indefinite by clear and convincing evidence. Plaintiffs are correct that what matters is a POSA would know to determine the heating curve ahead of time and he has the skill from knowledge of the prior art to do so. In addition, the '540 Patent does provide one example of a predetermined heating curve, creating an even stronger inference that a POSA would have the information needed to understand and navigate the confines of the patent. (See '540 Patent at Figure 2.)

Therefore, the court denies Salem's indefiniteness challenge here as well and, having reviewed Plaintiffs' proposed construction, adopts it. The term "the temperature of the glass follows a predetermined heating curve," as it appears in the '540 Patent, Claims 3, 12, 13, and 14, will be understood to mean "the temperature of the glass follows a heating curve determined beforehand." (Doc. 32-2 at 10.)

16. "from a starting moment of the heating"

Plaintiffs' Construction	Defendant's Construction
"when heating of the glass begins" (Doc. 32-2 at 8.)	Indefinite (Doc. 32-2 at 8.)

Lastly in its indefiniteness arguments, Salem argues that the term "from a starting moment of the heating" in Claim 8 of the '540 Patent is indefinite because it is not specific as to which heating it refers. Claim 8 reads in full: "A method as claimed in claim 5, wherein the blowing on the underside starts at a moment of 25 to 405 from a starting moment of the heating." ('540 Patent Claim 8 (emphasis added).) According to Salem, Claim 8 depends from Claim 5,¹⁴ which depends from Claim 1, which recites two distinct heatings: "heating from above and below."¹⁵ (See Doc. 38 at 17.) As set out earlier, Claim 1 provides:

The invention claimed is:

1. In a method of heating glass, the method comprising conveying glass through a tempering furnace during a heating cycle so that the glass is heated from above and below, the improvements consisting essentially of

¹⁴ Claim 5 provides: "A method as claimed in claim 1, wherein the blowing on the underside ends before the heating cycle ends, and lasts maximally for 60% of the heating cycle." ('540 Patent at Claim 5.)

¹⁵ Salem also notes that apart from the convection heating described in Claim 1 for the bottom side of the glass, there is also heating "by means of electrical resistors" that takes place on the bottom side, which is recited in Claim 2. ('540 Patent at Claim 2.) Salem argues that this further contributes to the confusion. (Doc. 45 at 9-10.)

heating an upper surface of the glass by hot air jets formed by sucking hot air from inside the furnace, pressurizing the hot air and recycling the pressurized hot air back to the upper surface of the glass for the heating from above, and

blowing air which has been taken from outside the furnace and which has been pressurized by a compressor and heated onto a lower surface of the glass for the heating from below.

(‘540 Patent at Claim 1.) Salem then argues that Claim 8 is not specific about which of the two heatings in Claim 1 the “starting moment” is meant to refer and that the specification and prosecution histories likewise do not illuminate this point. (Doc. 38 at 18.) Therefore, it argues, the claim term is indefinite under the Nautilus standard. (Id.)

Plaintiffs rebut Salem’s argument by noting that a common sense reading of the language of the claims makes clear that the patent refers to the top-side heating. According to Plaintiffs, Claim 1 recites a topside and a bottom-side heating. (‘540 Patent at Claim 1.) They contend that Claim 8 refers to the delayed start of “underside blowing” (the method for bottom-side heating), which Plaintiffs argue logically means that the delayed start refers to the only other heating step recited in Claim 1 – heating from above – as it cannot start later than, or be delayed as to, the same underside blowing. (Doc. 40 at 15.) Plaintiffs assert that this reading is confirmed by the specification and the testimony of Salem’s own expert, Mr. Bartoe. (Id. (citing ‘540 Patent at

Fig. 2, 5:6-27, 5:39-43; Doc. 40-5 at 89-90.) Therefore, they contend, this term should be deemed sufficiently definite.

The court is persuaded by Plaintiffs' logic and finds that Salem has failed to demonstrate by clear and convincing evidence that the term is indefinite. While Salem argues that Plaintiffs' reasoning ignores the existence of a second type of bottom side heating (namely, the heating of the lower surface of the glass from below by means of electrical resistors), that other heating is referenced in Claim 2 of the '540 Patent, which is outside of the dependency chain of Claim 8. When the claim chains are read together, Claim 8 necessarily refers to top-side heating described in Claim 1 and not the same bottom-side heating it describes. Therefore, the court declines to find this term is indefinite and, having reviewed Plaintiffs' construction, adopts it. The term "from a starting moment of the heating," as it appears in the '540 Patent, Claim 8, will be understood to mean "when heating of the glass begins." (Doc. 32-2 at 8.)

C. Means-Plus-Function and Section 112, Paragraph 6

Finally, there is a subset of the claim terms that Salem contends are indefinite and which Salem argues are means-plus-function terms. Means-plus-function claim limitations, authorized by 35 U.S.C. § 112 ¶ 6, allow a patentee to draft claims "as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof[.]"

This provision allows “patentees to express a claim limitation by reciting a function to be performed rather than by reciting structure for performing that function[.]” Williamson v. Citrix Online, LLC, 792 F.3d 1339, 1347 (Fed. Cir. 2015) (en banc). In this way, § 112 ¶ 6 allows a patentee to claim “not what an invention is but what an invention does.” Stephen Winslow, Means for Improving Modern Functional Patent Claiming, 98 Geo. L.J. 1891, 1892 (2010) (emphasis omitted).

The parties here dispute both whether certain terms are means-plus-function terms and, if so, whether they clear the limitation set by § 112 ¶ 6. When a claim term uses the word “means” and accompanies it with a description of a component’s function, there is a rebuttable (although not a “strong”) presumption that the term is a means-plus-function phrase under § 112 ¶ 6, and the party alleging otherwise has the burden of overcoming it. Williamson, 792 F.3d at 1348-49. Conversely, where a claim does not use the word “means,” there is a rebuttable presumption of equal strength that the term is not a means-plus-function term, and the burden to overcome it rests with the party seeking to the application of § 112 ¶ 6. Id. The presumption can be overcome and § 112 ¶ 6 will apply “if the challenger demonstrates that the claim term fails to recite sufficiently definite structure or else recites function without reciting sufficient structure for performing that function.” Id. at 1348 (internal quotation marks omitted). The

Federal Circuit has explained that “[g]eneric terms such as ‘mechanism,’ ‘element,’ ‘device,’ and other nonce words that reflect nothing more than verbal constructs may be used in a claim in a manner that is tantamount to using the word ‘means’” and therefore may trigger § 112 ¶ 6. Id. at 1350.

The inquiry for the court is whether “the claim language, read in light of the specification, recites sufficiently definite structure” such that it avoids being defined merely by its function. Robert Bosch, LLC v. Snap-On Inc., 769 F.3d 1094, 1099 (Fed. Cir. 2014); see Williamson, 792 F.3d at 1349. While a specification that describes only how a component part interacts with other parts of the invention may be sufficient to impart structure, the specification must still implicitly limit the claim term to some specific structure or structures. See Inventio AG v. ThyssenKrupp Elevator Ams. Corp., 649 F.3d 1350, 1358–59 (Fed. Cir. 2011) (“The written descriptions also show how the elements are connected together and to the elevator control and computing unit components of the elevator system.”), overruled by Williamson, 792 F.3d 1339 (Fed. Cir. 2015); cf. Media Rights Techs., Inc. v. Capital One Fin. Corp., 800 F.3d 1366, 1372–73 (Fed. Cir. 2015) (applying § 112 ¶ 6 when the only structural description in the specification was but one example of the disputed claim term). If a term is sufficiently structural on its own, then it is not a means-plus-function term, but if it is not,

then § 112 ¶ 6 applies. Williamson, 792 F.3d at 1347-49.

If the court determines that § 112 ¶ 6 applies, it next examines “whether the specification discloses sufficient structure that corresponds to the claimed function.” Id. at 1351. The “scope of coverage [is restricted] to only the structure, materials, or acts described in the specification as corresponding to the claimed function and equivalents thereof,” and the court has a duty to construe the term to fit that limitation. Id. at 1347; see Verint Sys. Inc. v. Red Box Recorders Ltd., 166 F. Supp. 3d 364, 375 (S.D.N.Y. 2016) (“The ambiguity [provided for in § 112 ¶ 6] comes at the cost of constraining the reach of the claim.”)

“The construction of a means-plus-function limitation follows a two-step approach.” Omega Eng’g, Inc. v. Raytek Corp., 334 F.3d 1314, 1321 (Fed. Cir. 2003); see Rain Computing, Inc. v. Samsung Elecs. Am., Inc., 989 F.3d 1002, 1007 (Fed. Cir. 2021). The first step requires identifying the function, “staying true to the claim language and the limitations expressly recited by the claims.” Omega, 334 F.3d at 1322. The second step is “ascertain[ing] the corresponding structures in the written description that perform those functions.” Id. “Under this second step, structure disclosed in the specification is corresponding structure only if the specification or prosecution history clearly links or associates that structure to the function recited in the claim.” Sony Corp. v. Iancu, 924 F.3d 1235, 1239 (Fed. Cir. 2019) (citation

omitted). Put differently, the “focus of the ‘corresponding structure’ inquiry is not merely whether a structure is capable of performing the recited function, but rather whether the corresponding structure is ‘clearly linked or associated with the [recited] function.’” Cypress Lake Software, Inc. v. Samsung Elecs. Am., Inc., 382 F. Supp. 3d 586, 599 (E.D. Tex. 2019) (alteration in original) (quoting Medtronic, Inc. v. Advanced Cardiovascular Sys., Inc., 248 F.3d 1303, 1311 (Fed. Cir. 2001)).

Under § 112 ¶ 6, however, “if a person of ordinary skill in the art would be unable to recognize the structure in the specification and associate it with the corresponding function in the claim, a means-plus-function clause is indefinite.” Williamson, 792 F.3d at 1352; see EON Corp. IP Holdings LLC v. AT&T Mobility LLC, 785 F.3d 616, 621 (Fed. Cir. 2015) (means-plus-function claim limitations must “satisfy the definiteness requirement of § 112 ¶ 2”); In re Aoyama, 656 F.3d 1293, 1294, 1297-98 (Fed. Cir. 2011) (finding a means-plus-function software patent claim was invalid as indefinite for failure to disclose the corresponding algorithm performing that function); Default Proof Credit Card Sys., Inc. v. Home Depot U.S.A., Inc., 412 F.3d 1291, 1302-03 (Fed. Cir. 2005) (invalidating a means-plus-function claim for indefiniteness for lack of a structure in the specification corresponding to the claimed function).

As with claim construction itself, the “determination that a

patent claim is invalid for failure to meet the definiteness requirement” of § 112 ¶ 6 is “a legal conclusion that is drawn from the court’s performance of its duty as the construer of patent claims[.]” All Dental Prodx, LLC v. Advantage Dental Prod., Inc., 309 F.3d 774, 778 (Fed. Cir. 2002) (alterations and citations omitted); see Atmel Corp. v. Info. Storage Devices, Inc., 198 F.3d 1374, 1379 (Fed. Cir. 1999). As to the burden of proof, “[t]he party alleging that the specification fails to disclose sufficient corresponding structure must make that showing by clear and convincing evidence.” TecSec, Inc. v. Int’l Bus. Machines Corp., 731 F.3d 1336, 1349 (Fed. Cir. 2013); see Nature Simulation Sys. Inc. v. Autodesk, Inc., 50 F.4th 1358, 1361 (Fed. Cir. 2022) (“United States patents are accompanied by a presumption of validity, 35 U.S.C. § 282, and invalidity must be established by clear and convincing evidence.”); Dow Chem. Co. v. Nova Chemicals Corp. (Canada), 809 F.3d 1223, 1227 (Fed. Cir. 2015) (Moore, J., concurring in the denial of rehearing en banc) (“Precedent . . . requires that the burden of proving indefiniteness remains on the party challenging validity and that they must establish it by clear and convincing evidence.”).

Salem contends that two terms, “a control unit arranged to control the blowing of pressurized air” and “a pressurization unit for pressurizing the air sucked from inside the tempering furnace,” are means-plus-function terms and are either invalid for

indefiniteness or substantially limited in scope by the operation of § 112 ¶ 6. Plaintiffs maintain that both are sufficiently structural terms rather than means-plus-function terms and propose a valid construction for each. The court addresses the arguments for each of these terms in turn below.

1. "a control unit arranged to control the blowing of pressurized air"

Plaintiffs' Construction	Defendant's Construction
"a controller to control air flow of pressurized air." (Doc. 32-2 at 12.)	Indefinite (Doc. 32-2 at 12.)

The parties dispute whether "a control unit arranged to control the blowing of pressurized air" as it appears in Claim 2 of the '911 Patent is a means-plus-function term. Claim 2 of the '911 Patent reads in full:

2. An apparatus as claimed in claim 1, the apparatus further comprising a control unit arranged to control the blowing of pressurized air provided by the compressor on the lower surface of the glass to end before a heating cycle ends and such that the blowing lasts maximally for 60% of an entire heating cycle.

('911 Patent at Claim 2 (emphasis added).) Salem argues that this term is means-plus-function: though the term does not recite the word "means," Salem contends it is nevertheless a means-plus-function term because "control" is a functional descriptor that modifies the nonce term "unit." (Doc. 38 at 16-17 (citing Diebold

Nixdorf, Inc. v. Int'l Trade Comm'n, 899 F.3d 1291, 1298 (Fed. Cir. 2018); Huawei Techs. Co. Ltd. v. T-Mobile US, Inc., No. 2:16-CV-00056-JRG-RSP, 2017 WL 2267304, at *17-19 (E.D. Tex. May 24, 2017); Williamson, 792 F.3d at 1351).) Salem asserts that the specification provides no additional structural details beyond depicting the control unit as a "black box," and it notes that Plaintiffs have not pointed to any evidence, either intrinsic to the patent or extrinsic, to suggest that the unit is structural in nature. (Id. (citing '540 Patent at 4:52-57, Fig. 1; Doc. 32-3 ¶¶ 65, 67 (Fackelman testimony)).) Therefore, Salem argues, the term should be interpreted as means-plus-function subject to the limitations of § 112 ¶ 6.

Plaintiffs deny Salem's contention and argue that the presumption is in their favor here, noting that the term does not recite the word "means" and that Salem has failed to meet its burden to overcome it. Plaintiffs maintain that "control units or controllers" are well-recognized structural units in patent law that a POSA would understand, particularly by reference to the depictions of how it interacts with other structures. (Doc. 40 at 16-17 (citing Doc. 40-5 at 139 (providing Mr. Bartoe's testimony that "[c]ontrol units or controllers were commonly used to ensure that the glass tempering furnace was set to the correct temperature for a particular glass tempering application" and would have been obvious to a POSA)).) Plaintiffs also note that the term "control

unit” is further defined within the patent by reference to the other components with which it interacts and how it relates to other structural entities, particularly in Figure 1, citing case law that reflects support for this reasoning. (Id. (citing ‘911 Patent at. Fig. 1 (showing a schematic diagram of how control unit 21 interacts with other components, particularly inverters 16 and 19, resistors 5 and 6, pressurization unit 10 and compressor 17); United States Well Servs. v. Tops Well Servs., No. 3:19-CV-00237, 2020 WL 9439469, at *22-24 (S.D. Tx. Sept. 18, 2020) (finding that “centralized control unit” is not subject to § 112 ¶ 6 where the intrinsic evidence describes functions of and the structural interactions between “other components” and the “centralized control unit” includes a schematic of how the “centralized control unit” interacts with other components)).) Thus, Plaintiffs argue, the term is not means-plus-function in nature.

As an initial matter, Plaintiffs are correct that, in the absence of the term “means” in the patent, Salem bears the burden of showing that it is means-plus-function. Williamson, 792 F.3d at 1348. Thus, while Salem argues that Plaintiffs have pointed to no evidence supporting their reading of the claim term as non-means-plus-function, it is Salem’s burden to show that the presumption in Plaintiff’s favor is inapplicable.

The court finds on the evidence before it that Salem has not made a sufficient showing to accomplish this. Though it cites

numerous cases with the term “control” as an adjective and “unit” as a nonce term,¹⁶ the term “control unit” is made distinct in this case, as Plaintiffs point out, by other reference to what it is, what it does, and how it interacts with other parts of the patented apparatus. Courts, including the Federal Circuit, have recognized that relational language to corresponding components can render a term sufficiently structural. Inventio AG, 649 F.3d at 1358-59; Ultra-Mek, Inc. v. United Furniture Indus., Inc., No. 1:18CV281, 2019 WL 4723351, at *6 (M.D.N.C. Sept. 26, 2019); U.S. Well Servs., 2020 WL 9439469. Here, the provided schematic of the control unit shows it attaches and works with six other components of the glass tempering invention, and the patent otherwise provides context in the specification and history for how these pieces relate to one another. (See, e.g., ‘911 Patent at 4:58-63.) Thus, the term “control unit” is not unmoored from any structural implication, as Salem suggests, but rather incorporates structure through its interactions.

Moreover, Salem’s own representations to the court and the

¹⁶ For the proposition that “unit” is a nonce term, Salem relies predominantly on Diebold Nixdorf, Inc., 899 F.3d at 1298; Huawei Techs. Co. Ltd., 2017 WL 2267304 at *17-19; Dionex Softron GmbH, 811 F. App’x at 632; and WSOU Investments LLC v. Google LLC, Nos. 2022-1066, 2022-1067, 2023 WL 6210607 (W.D. Tex. Sept. 25, 2023). For the proposition that adding the word “control” fails to impart any additional structure, Salem looks to Williamson, 792 F.3d at 1351; IPS Group, Inc. v. CivicSmart, Inc., No. 17-CV-632-CAB-(MDD), 2018 WL 6567843 (S.D. Cal. Mar. 29, 2019); and Anderson Corp. v. Fiber Composites, LLC, 474 F.3d 1361 (Fed. Cir. 2007).

evidence it presents undermine its position that "control unit" is a means-plus-function term because of a lack of structure. When asked at oral argument how the term should have been phrased to be sufficiently structural in Salem's view, counsel noted that "the patentee could have recited a more definite structure in the art, such as a controller," as "[a] controller is a known component in the electrical engineering field." (Doc. 89 at 62.) However, as Plaintiffs point out, Salem's own expert, Mr. Bartoe, in his testimony presented "control units or controllers" as interchangeable terms with identical meanings, both of which are known and understood by a POSA in the field. (See id. at 70; Doc. 40-5 at 139.) While Salem notes that Mr. Fackelman disagreed with Mr. Bartoe's characterization of these two as interchangeable, Mr. Fackelman's testimony suffers all of the previously discussed credibility problems along with a substantial new one raised by Plaintiffs: his own patent uses the term "control unit" as a meaningful term in the art. (See Doc. 40-11 at 107.) Therefore, the court declines to find that Salem has met its burden of showing this term is means-plus-function.

Salem conceded at oral argument that if the court held the term was not means-plus-function, no additional inquiry into the structure or definiteness of the term under § 112 ¶ 6 would be required. (See Doc. 89 at 76-77.) Thus, having found the term is not means-plus, the court declines to engage in the § 112 ¶ 6 two-

step inquiry. The court thereby adopts Plaintiffs' proposed construction. The term "a control unit arranged to control the blowing of pressurized air," as it appears in the '911 Patent, Claim 2, will be interpreted to mean "a controller to control air flow of pressurized air." (Doc. 32-2 at 12.)

3. "a pressurization unit for pressurizing the air sucked from inside the tempering furnace"

Plaintiffs' Construction	Defendant's Construction
"a pressurizing unit that pressurizes air by applying over pressure with respect to the pressure of the furnace." (Doc. 32-2 at 9.)	Governed by 112(6). Function: "pressurizing the air sucked from inside the tempering furnace," Structure: turbochargers or heat-endurance compressors. (Doc. 32-2 at 9.)

Finally, Salem challenges "a pressurization unit for pressurizing the air sucked from inside the tempering furnace," as it appears in Claim 1 of the '911 Patent, which reads in full:

1. An apparatus for heating glass, the apparatus comprising a tempering furnace comprising horizontal rolls arranged to carry the glass and to form a conveyor thereof, an upper side return pipe for sucking air from inside the tempering furnace, a pressurization unit for pressurizing the air sucked from inside the tempering furnace, means for blowing the pressurized air back to an upper surface of the glass, a compressor for pressurizing air taken from outside the furnace, a pipe system for conveying the air pressurized by the compressor to a lower surface of the glass, and means for heating the air pressurized by the compressor.

('911 Patent at Claim 1 (emphasis added).)

The argument and analysis for whether “a pressurization unit for pressurizing the air sucked from inside the tempering furnace,” as it appears in Claim 1 of the ‘911 Patent is largely duplicative of that for the preceding “control unit” term, which the parties acknowledge. (Doc. 89 at 78.) Plaintiffs again assert that the presumption lies in their favor, given that the term does not use the word “means” and that the term “pressurization unit” is a well-understood structural term that implicates a category of devices in the art such that it avoids § 112 ¶ 6. (See Doc. 40 at 24-26.) Salem maintains that despite not using the word “means,” the term is subject to § 112 ¶ 6 because “pressurization unit” is another “nonce” term with a functional adjective that is not sufficiently defined by its structure in the art and is instead defined by its functional operations. (Doc. 38 at 23-24.) Parties did not address this issue at oral argument, instead opting to rest on their briefs. (Doc. 89 at 78.)

As with the prior terms, Salem has not overcome the presumption that this term is not means-plus function. Because the parties in their briefs to some extent conflate the first stage of the analysis, determining whether the term is a means-plus-function term because it is not structural on its own, with the second stage of the analysis, determining whether the term is indefinite for failing to provide a sufficient structural limitation, it is unclear what evidence each offers on the first

issue. However, because the presumption falls in Plaintiffs' favor, this deficiency primarily undermines Salem's arguments. The only evidence that Salem expressly cites as indicating that a "pressurization unit" is not a term of art in the field of tempering glass or sufficiently structural on its own is the testimony of Mr. Fackelman, which the court has already discredited. (See Doc. 38 at 24 (citing Doc. 32-3 ¶ 91).) At a minimum, Plaintiffs have pointed to the testimony of Salem's other expert, Mr. Bartoe, suggesting that a POSA would understand the term (Doc. 40-5 at 40-43, 123-24) and several instances in the specification ('911 Patent at 3:57-58, 3:66-4:4, 3:54-62) that tend to suggest a "pressurization unit" would be understood as a defined class of structural components within the state of the art. Salem has not provided the court with credible testimony to refute either this evidence or the general presumption in Plaintiffs' favor.

As a result, this court finds that the term "a pressurization unit for pressurizing the air sucked from inside the tempering furnace" is not a means-plus-function term. Thus, it is not limited by the requirements of § 112 ¶ 6, and the court need not engage in that analysis. Plaintiffs' proposed construction prevails. The term "a pressurization unit for pressurizing the air sucked from inside the tempering furnace," as it appears in Claim 1 of the '911 Patent, will be construed to mean "a

pressurizing unit that pressurizes air by applying over pressure with respect to the pressure of the furnace.” (Doc. 32-2 at 9.)

III. CONCLUSION

For the reasons stated, the court finds that Plaintiffs’ arguments prevail in all instances, and each of their proposed constructions is adopted.

IT IS THEREFORE ORDERED that the disputed claim terms be construed as follows:

- “sucking [hot] air from inside the [tempering] furnace,” as recited in the ‘540 Patent, Claim 1, and in the ‘911 Patent, Claim 1, will be construed to mean “creating a pressure differential to pull air at elevated temperature from inside the furnace.”
- “the improvements consisting essentially of,” as recited in the ‘540 Patent, Claim 1, will be construed to include components or steps not listed in the claim so long as they do not materially alter the “heating” and “blowing” properties listed.
- “controlled in a forced manner so as to heat at a power level in accordance with a heating profile,” as recited in the ‘540 Patent, Claims 3, 12, 13, and 14, will be construed to mean “controlled to heat at a power level in accordance with a heating profile.”
- “heat, using forced control, at a power level in accordance with a heating profile,” as recited in the ‘911 Patent, Claim 4, will be construed to mean “heat at a power level in accordance with a heating profile.”
- “the temperature of the glass follows a predetermined heating curve,” as recited in the ‘540 Patent, Claims 3, 12, 13, and 14, will be construed to mean “the temperature of the glass follows a heating curve determined beforehand.”

- "from a starting moment of the heating," as recited in the '540 Patent, Claim 8, will be construed to mean "when heating of the glass begins."
- "a control unit arranged to control the blowing of pressurized air," as recited in the '911 Patent, Claim 2, will be construed to mean "a controller to control air flow of pressurized air."
- "a pressurization unit for pressurizing the air sucked from inside the tempering furnace," as recited in the '911 Patent, Claim 1, will be construed to mean "a pressurizing unit that pressurizes air by applying over pressure with respect to the pressure of the furnace."

/s/ Thomas D. Schroeder
United States District Judge

April 18, 2024